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1.	**INSTITUTION NAME**	Lakshmibai National Institute of Physical Education, NERC, Guwahati
2.	**DEPARTMENT**	Exercise Physiology
3.	**NAME OF PH.D. SCHOLAR (eg. Surname, First Name, Middle name)**	Hina, Madin
4.	**NAME OF SUPERVISOR (don't use Professor/Doctor) *please enter Joint Supervisor name/Co-Supervisor name, if any, separated by 'and' (e.g. Yadav, Ravi and Sharma, Ashish)**	Yadav, Ramesh, Chand
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7.	**http://title/TOPIC%20(Special%20Characters%20&!#$%^*()+=-[]\\\';,./{%20}|\:?%20etc.%20are%20not%20allowed)**	IMPACT OF DIFFERENT PERCENTAGE OF RAPID WEIGHT LOSS IN THE PHYSIOLOGICAL VARIABLES, ANTHROPOMETRIC CHARACTERISTICS AND SPECIFIC JUDO FITNESS
8.	**ABSTRACT Abstract should not contain any [E.g. !@ #$%^&*() etc. and more than 2048 characters will not be acceptable]**	Rapid weight loss is prevalent among judo athletes aiming to compete in lower weight categories, yet its optimal extent is unclear due to potential health and performance consequences. This study investigates the impact of different rapid weight loss percentages (0 percent, 3 percent, 5 percent, 7 percent of body weight) on 40 male national-level Indian judo athletes (aged 18 plus or minus 2.5 years, experience 5 plus or minus 2 years, rank at least 1st Kyu). Participants were randomly divided into four groups (10 per group) and underwent a 7-day rapid weight loss protocol involving caloric restriction, aerobic training in plastic suits, judo drills (uchikomi, randori), and plyometric exercises. Pre- and post-intervention assessments, conducted in controlled conditions (22 to 24 degrees Celsius, 50 to 60 percent humidity), evaluated anthropometric measures (body fat percentage, muscle mass, hip-to-waist ratio), physiological parameters (handgrip strength, heart rate recovery, blood lactate clearance), and performance indicators (Special Judo Fitness Test, Dynamic and Isometric Chin-Up Tests, Counter-Movement Jump, Rate of Perceived Exertion via Borg CR-10 scale). A mixed experimental design with within-group (pre-post) and between-group (rapid weight loss percentages)

		analyses employed two-way ANOVA, Bonferroni tests, t-tests, and Pearsons's correlations. Ethical approval and informed consent ensured participant safety. The study seeks to identify an optimal rapid weight loss threshold that minimizes health risks, such as dehydration and muscle loss, while preserving performance, offering evidence-based recommendations for weight management, nutrition, and regulations in judo and comparable sports. Results will advance sports science and assist coaches, trainers, and athletes.
9.	**KEYWORDS (please mention more than one keyword)**	**Keywords:** rapid weight loss, judo, anthropometric measurements, physiological parameters, performance metrics, weight-class sports.
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IMPACT OF DIFFERENT PERCENTAGE OF RAPID WEIGHT LOSS IN THE PHYSIOLOGICAL VARIABLES, ANTHROPOMETRIC CHARACTERISTICS AND SPECIFIC JUDO FITNESS

SHORT SYNOPSIS

Submitted in partial fulfillment of the requirement of the degree of
DOCTOR OF PHILOSOPHY

to

Lakshmibai National Institute of Physical Education, NERC, Guwahati

by

Madin Hina

(Ghy-06)

Under the supervision of
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I hereby declare that the short synopsis **"Impact of Different Percentage of Rapid Weight Loss in the Physiological Variables, Anthropometric Characteristics and Specific Judo Fitness"** being submitted in partial fulfillment of the requirement for the degree of Doctor of Philosophy at Lakshmibai National Institute of Physical Education, NERC, Guwahati during the academic year 2024-2025.

It is a bonafide record of original work carried out under the supervision of Dr. Ramesh Chand Yadav and has not been submitted in full or in part to any other university or institute for a degree or diploma. Further, it is certified that the short synopsis is plagiarism-free and the proof has been submitted.

(Madin Hina)

Ghy-06

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Abstract

Rapid weight loss (RWL) is common among judo athletes to compete in lower weight classes, but its optimal level remains uncertain due to potential health risks and performance impacts. This study examines the effects of varying RWL percentages (0%, 3%, 5%, 7% body weight loss) on 40 male national-level Indian judo athletes (age: 18 ± 2.5 years, experience: 5 ± 2 years, rank: ≥ 1st Kyū). Participants were randomly assigned to four groups (n=10 each) and underwent a 7-day RWL intervention involving caloric restriction, aerobic training in plastic suits, judo drills (uchikomi, randori), and plyometrics. Pre- and post-intervention assessments, conducted under controlled conditions (22-24°C, 50-60% humidity), measured anthropometric variables (body fat percentage, muscle mass, hip-to-waist ratio), physiological parameters (handgrip strength, heart rate recovery, blood lactate clearance), and performance metrics (Special Judo Fitness Test, Dynamic/Isometric Chin-Up Tests, Counter-Movement Jump, RPE via Borg CR-10 scale). A mixed experimental design with within-group (pre-post) and between-group (RWL percentages) analyses used two-way ANOVA, Bonferroni tests, t-tests, and Pearson's correlations. Ethical approval and consent ensured participant safety. The study aims to determine an optimal RWL threshold that minimizes health risks (e.g., dehydration, muscle loss) while maintaining performance, providing evidence-based guidance for weight management, nutrition, and regulations in judo and similar sports. Findings will enhance sports science knowledge and support coaches, trainers, and athletes.

Keywords: rapid weight loss, judo, anthropometric measurements, physiological parameters, performance metrics, weight-class sports, athlete health

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INTRODUCTION

Sports have profoundly shaped human society, serving as a universal medium that transcends cultural, linguistic, and geographical boundaries to foster discipline, teamwork, and perseverance. They promote physical health by enhancing cardiovascular fitness, musculoskeletal strength, and flexibility, while acting as a preventive measure against chronic conditions like obesity, diabetes, and heart disease. Regular participation in sports boosts immune function and longevity, underscoring their critical role in public health. Psychologically, sports reduce stress, anxiety, and depression through endorphin release, while fostering self-esteem, resilience, and a sense of achievement through goal-setting and personal development. The communal nature of sports builds interpersonal connections, mitigates social isolation, and cultivates belonging, particularly in team-based activities. Beyond individual benefits, sports drive social cohesion, national pride, and economic growth by creating jobs, boosting tourism, and spurring infrastructure development. Global events like the Olympic Games exemplify their capacity for international cooperation and cultural exchange, with athletes' achievements symbolizing collective identity and national resilience. Technological advancements, such as wearable devices and data analytics, have revolutionized training methodologies, while efforts toward gender equality and accessibility have expanded participation for women and individuals with disabilities, ensuring sports remain inclusive and dynamic. Among athletic disciplines, judo stands out as a martial art that harmoniously blends physical rigor, mental fortitude, and philosophical principles, embodying the vision of its founder, Jigoro Kano, who described it as "the way to the most effective use of both physical and spiritual strength." Established in 1882 with the founding of the Kodokan in Tokyo, judo evolved from traditional jujitsu to prioritize technique and leverage over brute strength, aiming to refine both body and soul. Its core techniques, including Nage-waza (throws), Katame-waza (grappling), and Kaeshi-waza (counter-techniques), demand precise timing, balance, and adaptability, reflecting the sport's emphasis on fluidity and strategic acumen. Judo's inclusion in the Olympic Games in 1964 for men and 1992 for women elevated its global profile, transforming it into a premier competitive sport while preserving its values of respect, perseverance, and mutual welfare. The sport's weight-class system, formalized during its Olympic debut, categorizes athletes by body mass to ensure fair competition, prioritizing skill over physical disparity. Early judo competitions, rooted in Kano's principle of ju-no-ri (gentle flexibility), lacked weight divisions, as technique was believed to triumph over size, but international expansion necessitated structured categories, with men's divisions expanding to

six by 1972 and women's judo adopting a parallel structure by 1996. Today, the International Judo Federation maintains seven weight classes for men (-60 kg, -66 kg, -73 kg, -81 kg, -90 kg, -100 kg, +100 kg) and women (-48 kg, -52 kg, -57 kg, -63 kg, -70 kg, -78 kg, +78 kg), reflecting modern athlete morphologies. Weight categories enhance safety, promote diversity, and ensure equitable matchups, but they also drive athletes to engage in rapid weight loss (RWL) to compete in lower divisions, seeking a perceived advantage over smaller opponents. RWL is pervasive in weight-class sports like judo, wrestling, boxing, and mixed martial arts, with 50–90% of combat sport athletes, including judokas, reporting weight losses of 2–10% of body mass in the days before competition. Common RWL methods include gradual dieting, fluid restriction, increased exercise, and sauna use, though some athletes resort to extreme measures like laxatives, diuretics, or vomiting, despite their prohibition by regulatory bodies. While RWL may improve strength-to-weight ratios, it poses significant risks, as dehydration from just 2% body weight loss can impair endurance, strength, and cognitive function. Repeated RWL cycles may lead to long-term health issues, including eating disorders, menstrual irregularities, and reduced bone density, particularly among female athletes, while also raising ethical concerns about fairness, as weight-cutting athletes may gain an advantage over those competing at their natural weight. Judo's dynamic nature, characterized by high-intensity bursts and brief recoveries in five-minute matches, demands anaerobic power, aerobic endurance, strength, and technical proficiency, placing significant stress on the anaerobic glycolytic system. To assess judo-specific performance, tests like the Special Judo Fitness Test (SJFT), developed by Sterkowicz in 1995, evaluate anaerobic endurance, explosive strength, and cardiovascular recovery through repeated Ippon Seoi Nage throws over three timed periods, offering high specificity to judo movements. The Isometric and Dynamic Judogi Chin-Up Tests measure upper body strength and endurance, critical for grip fighting, while the Counter-Movement Jump Test assesses lower body power, essential for explosive throws. Handgrip strength, measured isometrically, correlates with judo performance due to the sport's reliance on gripping the opponent's judogi, and blood lactate and heart rate tests provide insights into anaerobic capacity and recovery efficiency. The Rate of Perceived Exertion (RPE), assessed via the Borg CR-10 scale, offers a subjective measure of exertion, reflecting mental and physical strain. Body composition, including body fat percentage, muscle mass, and hip-to-waist ratio, is assessed using skinfold calipers to track RWL-induced changes, as high fat percentages reduce performance in body-displacement activities, and preserving muscle mass is vital for maintaining strength and metabolic rates. RWL often reduces both fat and muscle mass, potentially compromising performance if not managed carefully, with gradual weight

loss strategies preferred to minimize muscle loss. Despite RWL's prevalence in judo, its effects on physical, physiological, and performance variables remain underexplored, particularly regarding an optimal weight loss threshold that balances competitive advantage with health. Excessive RWL can impair strength, endurance, and recovery, while strategic RWL may enhance performance if muscle integrity and physiological function are preserved. This study aims to examine the effects of varying RWL degrees on judo athletes, focusing on physical variables (hip-to-waist ratio, body fat percentage, muscle mass), physiological variables (handgrip strength, heart rate recovery, lactate clearance), and performance variables (SJFT, Dynamic and Isometric Judogi Chin-Up Tests, RPE). By quantifying these impacts, the study seeks to identify an optimal RWL threshold that minimizes adverse effects while maintaining or enhancing competitive performance, offering evidence-based recommendations for weight management in judo. The findings will inform training protocols, nutritional strategies, and regulatory guidelines, promoting athlete welfare, fair play, and the enduring legacy of judo as a sport that refines both body and soul.

REVIEW OF LITERATURE

Prevalence and Methods of Rapid Weight Loss

Zhong et al. (2024) conducted a systematic review (PROSPERO: CRD42023487196) analyzing weight loss practices across 26 studies involving 3994 participants from 14 combat sports. The review found RWL to be highly prevalent, with athletes typically losing less than 5% of body weight within 7–14 days before competition. Common methods included increased exercise and gradual dieting, often initiated during adolescence and repeated two to three times annually. Notably, scientific practitioners had minimal influence, leading to reliance on non-qualified advice and potentially harmful practices. This underscores the need for evidence-based interventions to guide safe weight management.

Danilo França Conceição dos Santos et al. (2024) performed a scoping review of 53 studies, reporting RWL prevalence in judo athletes ranging from 40% to 92.9%, with an average body mass reduction of ~5%. Common methods included fluid restriction and increased exercise, often influenced by coaches. The review highlighted that RWL negatively impacts performance and health without adequate recovery (>4 hours), emphasizing the importance of monitoring recovery periods in RWL studies.

Artioli et al. (2010) surveyed 822 judo athletes, finding that 86% engaged in RWL, with most reducing up to 5% of body weight (average 2.5%) over seven days, starting as early as age 12.6. Elite athletes exhibited more aggressive RWL behaviors, highlighting the need for targeted education to mitigate risks.

Kons et al. (2018) studied 12 male judo athletes, reporting an average 7.1 kg body weight reduction using increased exercise (91.7%) and fluid restriction (41.7%), with coaches as primary influencers. Significant reductions in body fat (2.4%) and fat-free mass (2%) were observed, aligning with the proposed study's focus on body composition changes.

Štangar et al. (2022) surveyed 138 elite judokas, finding 96% practiced RWL, reducing body mass by 5.8% on average using fluid restriction (88%) and sauna suits (85%). Negative effects included reduced energy (91%) and collapse episodes (21%), particularly in lower-ranked athletes, suggesting that professional support could mitigate risks.

Physiological and Performance Impacts

Martínez-Aranda et al. (2023) reviewed 16 studies involving 184 combat sports athletes, finding that RWL of 3–6% or higher negatively affected performance, perceived fatigue, mood, strength, and power. Weight loss below 3–5% with ≥24-hour recovery was less detrimental, supporting the proposed study's investigation of varying RWL percentages.

Laurie Isacco et al. (2019) examined 20 national judo athletes during a simulated competition, comparing a 3% weight loss group to a weight-stable group. The weight loss group showed increased mood disturbances, elevated ammonia and urea levels, and reduced strength and endurance, particularly in later fights, highlighting the cumulative impact of RWL on performance.

Bouzoualegh et al. (2023) studied 21 male judokas, finding that muscle power and aerobic capacity were critical for performance in the Special Judo Fitness Test (SJFT). Higher lactate concentrations in medium-heavy weight categories suggest that RWL may exacerbate metabolic stress, relevant to the proposed study's focus on blood lactate and SJFT performance.

Ceylan et al. (2022) assessed 27 elite judo athletes during a weight-stable training camp, reporting hypohydration in 92.6% (USG ≥ 1.020), exacerbated by training. This emphasizes the need to monitor hydration status during RWL, as proposed in the current study.

Hariadi et al. (2022) surveyed 88 Indonesian martial arts athletes, finding that RWL using sauna suits caused muscle cramps (19%), increased fatigue (49%), and decreased performance (16%). These findings underscore the multidimensional risks of RWL, supporting the inclusion of physiological and subjective measures like RPE in the proposed study.

Psychological and Behavioral Factors

Rossi et al. (2022) reviewed 17 studies involving 721 judo athletes, finding that psychological factors like anxiety, tension, and motivation significantly influenced performance. RWL increased negative psychological states, particularly in athletes facing defeat, suggesting that psychological assessments should complement physiological measures in RWL studies.

Pettersson et al. (2013) conducted a qualitative study with 14 combat sports athletes, revealing that RWL served as a coping strategy, enhancing focus and sport identity. However, the physical risks of extreme methods highlight the need to balance psychological benefits with health considerations, relevant to the proposed study's inclusion of weight loss questionnaires.

Wu et al. (2023) studied 138 tug-of-war athletes, emphasizing mental toughness as critical for enduring RWL challenges. This suggests that psychological resilience could moderate RWL effects, warranting further exploration in judo athletes.

Nutritional and Recovery Strategies

Sung et al. (2024) surveyed 22 coaches and 88 athletes, finding that higher nutritional knowledge in coaches correlated with better weight loss strategies and macronutrient intake ($p < 0.001$). This supports the need for professional guidance to optimize RWL practices.

Vicente-Salar et al. (2022) reviewed 55 RCTs, identifying caffeine (5–10 mg/kg) as an effective ergogenic aid for enhancing glycolytic energy production and performance in combat sports. This could inform recovery strategies in the proposed study to mitigate RWL's negative effects.

Ahokas et al. (2019) compared water immersion recovery methods, finding cold water immersion (CWI) most effective in reducing core temperature and fatigue. Integrating CWI into RWL recovery protocols could preserve performance, aligning with the proposed study's focus on recovery periods.

Garthe et al. (2011) compared slow (0.7% BW/week) and fast (1.4% BW/week) weight loss in 24 elite athletes, finding that slow reduction preserved lean body mass (LBM) and increased strength, while fast reduction did not. This supports gradual RWL approaches to minimize performance decrements.

Anthropometric and Fitness Considerations

Roklicer et al. (2020) analyzed somatotypes of 98 judokas, finding lightweight athletes as ectomorphic mesomorphs and heavier athletes as endomorphic mesomorphs. These differences suggest that RWL effects may vary by weight category, necessitating tailored assessments in the proposed study.

Franchini et al. (2014) studied 104 Brazilian judo athletes, reporting significant differences in bone breadth and circumferences across weight categories. This highlights the importance of anthropometric profiling to understand RWL's impact on body composition.

Branco et al. (2021) found that an 8-week strength training program improved SJFT performance and maximal strength in cadet judo athletes without altering body mass. This suggests that strength training could counteract some RWL-induced performance declines.

Recommendations and Implications

Burke et al. (2021) provided an expert consensus recommending minimal competition weight classifications, shorter weigh-in intervals, and banning unhealthy RWL methods. These align with the proposed study's aim to develop evidence-based weight management strategies.

Lakičević et al. (2020) reviewed 14 studies, noting inconsistent physiological effects but consistent psychological detriments (increased tension, fatigue) from RWL. The authors advocated for monitoring minimal competitive weight to prioritize athlete health, supporting the proposed study's comprehensive approach.

Malliaropoulos et al. (2019) reported an 84% RWL prevalence among 256 British judo athletes, with moderate knowledge of physiological effects. Educational programs targeting elite and youth athletes could reduce aggressive RWL behaviors, informing the proposed study's recommendations.

Statement of the Problem

The practice of rapid weight loss (RWL) is deeply ingrained in judo due to its weight-class system, yet the optimal degree of weight loss that minimizes adverse effects on health and performance remains unclear. Excessive or poorly managed RWL can impair strength, endurance, and recovery, while also posing risks such as dehydration, electrolyte imbalances, and long-term health issues. Conversely, strategic RWL may enhance performance by improving power-to-weight ratios, provided it preserves muscle integrity and physiological function. Existing research lacks consensus on the specific impacts of varying RWL percentages on judo athletes, particularly regarding anthropometric, physiological, and performance variables. This study addresses this gap by exploring the effects of different RWL degrees on anthropometric measurements (hip-to-waist ratio, body fat percentage, muscle mass), physiological variables (handgrip strength, heart rate recovery, lactate recovery), and judo-specific performance indicators (Dynamic and Isometric Chin-Up Tests, Special Judo Fitness Test, Rate of Perceived Exertion). The findings will contribute to identifying optimal weight loss strategies for judokas, promoting better health outcomes and competitive success.

Objectives of the Study

The study aims to achieve the following objectives:

1. To examine the effect of different percentages of rapid weight loss on anthropometric measurements, including hip-to-waist ratio, body fat percentage, and muscle mass.

2. To assess the impact of rapid weight loss on physiological variables, such as handgrip strength, heart rate recovery, and lactate recovery.

3. To evaluate changes in upper body strength and endurance through Dynamic and Isometric Chin-Up Tests across different levels of weight loss.

4. To analyze variations in judo-specific performance using the Special Judo Fitness Test at varying levels of weight loss.

5. To investigate the effect of rapid weight loss on athletes' Rate of Perceived Exertion (RPE).

6. To determine the degree of rapid weight loss that optimally balances performance and health for judo athletes.

Hypotheses

Based on a review of related literature and the researcher's understanding, the following hypotheses are proposed:

1. There will be significant differences in anthropometric variables (hip-to-waist ratio, body fat percentage, and muscle mass) across different levels of rapid weight loss.
2. Rapid weight loss will have a significant negative effect on physiological variables, including handgrip strength, heart rate recovery, and lactate recovery.
3. Upper body strength and endurance, as measured by Dynamic and Isometric Chin-Up Tests, will decrease significantly with higher levels of rapid weight loss.
4. Performance in the Special Judo Fitness Test will decline significantly at higher percentages of weight loss.
5. Athletes' Rate of Perceived Exertion (RPE) will increase with higher levels of rapid weight loss.
6. Moderate levels of rapid weight loss will show minimal adverse effects on performance and health compared to higher levels.

Delimitations

The study is delimited as follows:

Population Delimitation

1. The study is restricted to male judo players in India.
2. The study includes 40 male judokas aged 18 ± 2.5 years.
3. Participants are national-level judo players with competitive experience of 5 ± 2 years.
4. Only judo athletes with at least a 1st Kyū (brown belt) rank are included.

Weight Loss Experience Delimitation

1. The study is limited to players who have previously undergone weight loss of 4–8% of their body weight once or twice annually.

Variable Delimitation

The study focuses on a range of variables, including anthropometric measurements such as body fat percentage and muscle mass, physiological variables such as isometric handgrip strength, lower leg explosiveness (measured by Counter Movement Jump), and upper body explosiveness (assessed through Dynamic Judogi Chin-Up and Isometric Judogi Chin-Up), cardiovascular and metabolic variables such as heart rate and blood lactate, and performance and perception variables such as specific physical fitness of judoka (evaluated using the Special Judo Fitness Test) and Rate of Perceived Exertion (RPE).

Limitations

The study acknowledges the following limitations:

1. The body composition of participants may limit the generalizability of findings to broader populations or athletes from other sports.
2. External factors, such as daily routines, dietary habits, hydration levels, and sleep patterns, were not fully controlled and may have influenced outcomes.
3. Weather conditions, including temperature and humidity, may have introduced variability in physiological and performance data.
4. Genetic factors, such as metabolism, muscle fiber composition, and recovery capacity, were not accounted for and could have affected individual responses.
5. The psychological state of participants, including stress and motivation, was not monitored, potentially impacting performance and subjective ratings.
6. The absence of specialized motivational techniques or incentives may have affected participants' engagement and effort during tests.
7. The study focused on short-term effects of RWL, excluding long-term health implications or recovery profiles.

8. The sample size may not capture the full range of variability in responses to weight loss among judokas.
9. Testing under controlled conditions may not fully replicate the dynamic nature of competitive environments.
10. External influences, such as pre-existing injuries, undiagnosed medical conditions, or supplementation practices, were not investigated and may have impacted findings.

Significance of the Study

This study holds significant value for sports science, particularly in weight-class sports like judo, where rapid weight loss (RWL) is commonly practiced. The research will contribute to optimizing weight management strategies by identifying the most effective RWL percentage that maintains both performance and athlete safety. It will provide a scientific basis for developing tailored weight loss programs, helping athletes minimize performance drawbacks while ensuring competitive readiness.

The findings will offer valuable insights for future research, enhancing the understanding of RWL's physiological and performance-related effects in judo and similar sports. Additionally, the study will examine key physiological implications, such as changes in blood lactate and glucose levels, advancing knowledge on safe weight manipulation practices.

By establishing evidence-based guidelines, this research will serve as a foundation for promoting athlete health alongside competitive performance. It will provide practical strategies to balance weight management with essential athletic attributes like strength, endurance, and explosive power. Coaches, trainers, and nutritionists will benefit from scientifically supported recommendations, enabling them to prepare athletes more effectively while prioritizing well-being.

Research Methodology

Research Design

The study will employ a mixed experimental design, incorporating both within-group (pre-post comparisons) and between-group (different weight loss percentages) analyses to evaluate the effects of rapid weight loss (RWL) on judo athletes.

Selection of Subjects

A total of 40 male national-level judo players (age: 18 ± 2.5 years) will be selected based on strict inclusion criteria, including minimum 5 years of competitive experience and brown belt (1st Kyū) ranking. Participants will be randomly assigned into four groups: Control (0% RWL), 3% RWL, 5% RWL, and 7% RWL (n=10 per group).

Variables

Independent Variable: Percentage of rapid weight loss (0%, 3%, 5%, 7%).

Dependent Variables:

Anthropometric: Body fat percentage, muscle mass.

Physiological: Handgrip strength, countermovement jump, judogi chin-up performance.

Cardiovascular & Metabolic: Heart rate, blood lactate.

Performance & Perception: Special Judo Fitness Test (SJFT), Rate of Perceived Exertion (RPE).

Data Collection Procedures

Baseline and post-intervention tests will be conducted under controlled lab conditions (22-24°C, 50-60% humidity) at a fixed time (8:00-10:00 AM). Standardized equipment (e.g., ACCUNIQ BC380 for body composition, Polar H10 for heart rate, Lactate Scout 4 for blood lactate) will be used, and participants will follow pre-test restrictions (no caffeine/alcohol 24h prior).

Intervention Protocol

A 7-day RWL program will be implemented, combining caloric restriction, aerobic training in plastic suits, judo-specific drills (uchikomi, randori), and plyometric exercises to achieve targeted weight loss percentages.

Within-Group Design

A within-group design will be implemented where all participants will complete identical testing before and after the intervention. Baseline measurements will include body composition (fat percentage, muscle mass), handgrip strength (both hands), countermovement jump height, and judogi chin-up tests (dynamic and isometric). Resting heart rate and blood lactate levels will also be recorded. Following baseline tests, participants will perform the Special Judo Fitness Test (SJFT). Post-SJFT assessments will measure handgrip strength, heart rate recovery, blood lactate, and perceived exertion (RPE) immediately after exercise and at 1, 3, 5, 10, and 15-minute intervals.

After initial testing, participants will undergo a 7-day rapid weight loss protocol specific to their assigned group. No additional training or dietary interventions will be permitted. Post-intervention testing will replicate the baseline procedures under controlled conditions to ensure consistency and minimize variability.

WITHIN GROUP DESIGN

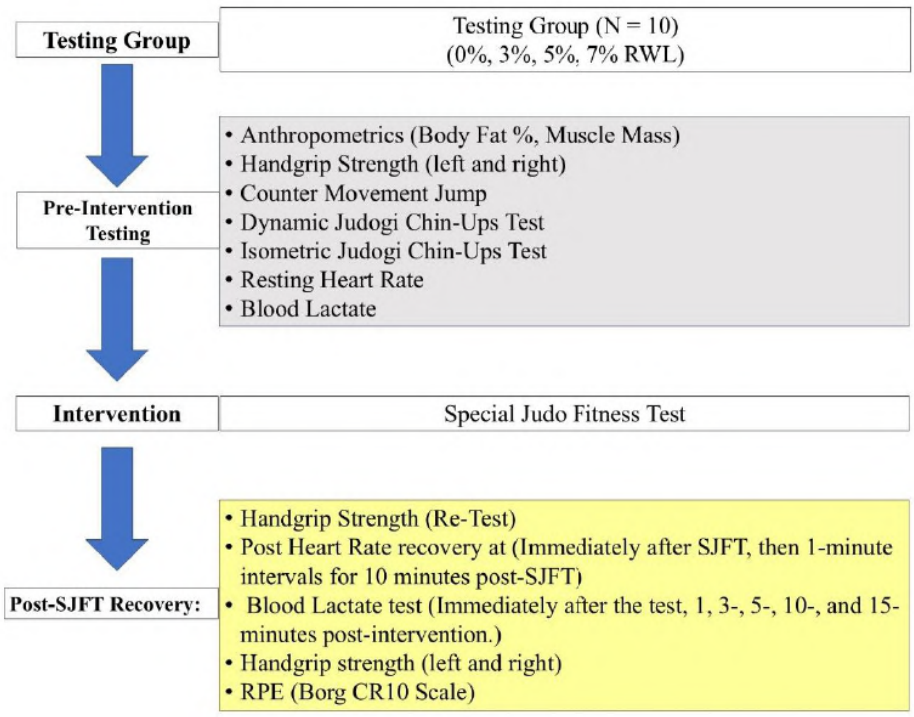
Testing Group
Testing Group (N = 10)
(0%, 3%, 5%, 7% RWL)
Pre-Intervention Testing
• Anthropometrics (Body Fat %, Muscle Mass)
• Handgrip Strength (left and right)
• Counter Movement Jump
• Dynamic Judogi Chin-Ups Test
• Isometric Judogi Chin-Ups Test
• Resting Heart Rate
• Blood Lactate
Intervention
Special Judo Fitness Test
Post-SJFT Recovery:
• Handgrip Strength (Re-Test)
• Post Heart Rate recovery at (Immediately after SJFT, then 1-minute intervals for 10 minutes post-SJFT)
• Blood Lactate test (Immediately after the test, 1, 3-, 5-, 10-, and 15-minutes post-intervention.)
• Handgrip strength (left and right)
• RPE (Borg CR10 Scale)

Figure: *Within -group testing procedure.*

Between-Group Design

The study will utilize a between-group design to compare the effects of different rapid weight loss percentages (0%, 3%, 5%, 7%) across experimental groups. This approach will enable analysis of how varying weight loss magnitudes affect performance metrics, recovery patterns, and physiological adaptations, potentially identifying dose-response relationships.

By combining this between-group comparison with the within-group longitudinal analysis, the research will employ a comprehensive dual-method design. This robust framework will allow simultaneous examination of both individual athlete adaptations and cross-group differences resulting from rapid weight loss protocols in competitive judo practitioners.

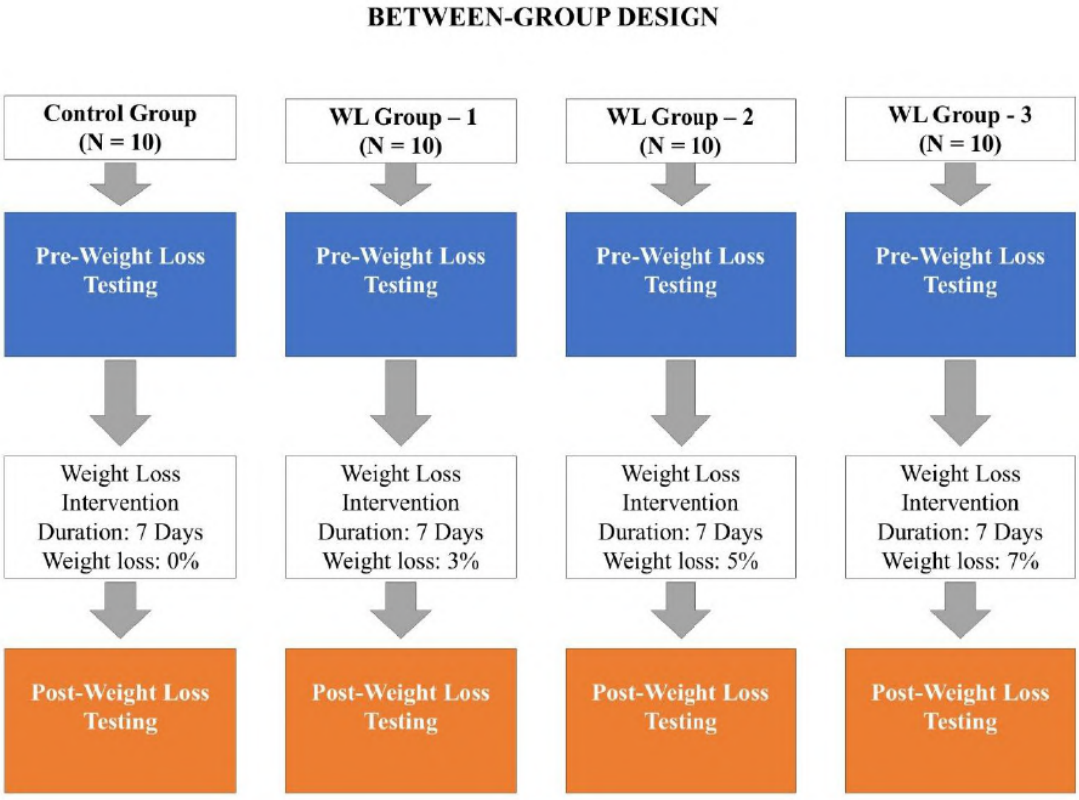
BETWEEN-GROUP DESIGN
Control Group (N = 10)
WL Group – 1 (N = 10)
WL Group – 2 (N = 10)
WL Group - 3 (N = 10)
Pre-Weight Loss Testing
Pre-Weight Loss Testing
Pre-Weight Loss Testing
Pre-Weight Loss Testing
Weight Loss Intervention Duration: 7 Days Weight loss: 0%
Weight Loss Intervention Duration: 7 Days Weight loss: 3%
Weight Loss Intervention Duration: 7 Days Weight loss: 5%
Weight Loss Intervention Duration: 7 Days Weight loss: 7%
Post-Weight Loss Testing
Post-Weight Loss Testing
Post-Weight Loss Testing
Post-Weight Loss Testing

Figure: *Between-group testing procedure.*

Data Analysis

Statistical Techniques

The study will employ a comprehensive statistical approach to examine the effects of rapid weight loss on judo athletes' performance and physiological parameters. Descriptive statistics will be calculated for all variables, including means, standard deviations, and ranges, to summarize the central tendencies and variability across the four experimental groups (Control, 3%, 5%, and 7% weight loss).

Inferential Analysis

A two-way repeated measures ANOVA will be conducted to assess both within-group (pre-post intervention) and between-group differences. This analysis will identify significant changes attributable to the weight loss interventions while accounting for the repeated measurements design. For comparisons at specific timepoints, one-way ANOVA will be utilized to examine group differences based on weight loss percentages.

Post-hoc Tests and Supplementary Analyses

Following significant ANOVA results, Bonferroni post-hoc tests will be performed for pairwise comparisons, controlling for Type I error. Paired t-tests will complement these analyses by examining pre-to-post changes within each group. Pearson's correlation coefficients will be calculated to explore relationships between weight loss percentages and key performance outcomes.

Effect Size and Data Visualization

The study will compute effect sizes (Cohen's d for paired comparisons, Partial Eta Squared for ANOVA models) to determine the practical significance of findings. Graphical representations

including line graphs, box plots, and bar charts will be generated to visually present trends and group differences.

Statistical Software and Significance Level

All analyses will be performed using IBM SPSS Statistics software, with a predetermined significance level of $\alpha = 0.05$. This multi-faceted analytical approach will ensure rigorous evaluation of rapid weight loss effects on combat sport athletes' physiological and performance characteristics.

Ethical Considerations

Ethical approval will be obtained, and informed consent will be secured from all participants, who will be free to withdraw at any stage.

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